BiocharLife

An Impact Venture by Warm Heart Worldwide

Solution Overview, Procedures and Methods

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Summary

This document provides details pertaining to the solution for the efficient education, tracking and issuance of C-sink credits via the production and application of biochar by smallholder farmers.

We are very grateful for our strategic partners Ithaka Institute and Task.io in the design and implementation of the solution.

Definitions

The following includes key definitions of terms to help facilitate understanding of the solution.

- Biochar produced. The process of making biochar from waste crop residue / biomass using pyrolysis equipment.
- Biochar used. The process of applying the biochar, such as mixing into the soil or animal feed.
- Crop residue. Crop residues, sometimes referred as crop waste biomass, are materials left in an agricultural field after the crop has been harvested. These residues include stalks and stubble, leaves and seed pods.

Solution Overview

The solution is organized into three primary operational steps: farmer training, biochar production and biochar usage (i.e., application). Each step includes specific activities and procedures that are leveraged by biochar producers (e.g., farmers) and data gatherers. These activities are verified and recorded on the blockchain using Task.io platform and mobile application.

The procedures and data requirements are aligned to the European Biochar Certification (“EBC”) - tropical farmer requirements.

- Step one. **Train** farmers to make biochar using a trench, trough, TLUD or other approved methods (see Pyrolysis Technology section). The training also includes methods to use (i.e., apply) the biochar, such as fertilizer or soil amendment. In the case of data gatherers (and farmers if they have a smartphone), the training includes how to use the Task.io mobile app.

- Step two. When farmers **produce** biochar, either a farmer or designated data gatherer records key data points such as pictures of the production, technology used, and specific crop waste. Our team verifies the weight of the biochar and the distance it has traveled if any. The farmer will be asked to sign a declaration that he/she will no longer open-field burn their crops or use the crop residues (i.e., biomass) . See Appendix below.

If the biochar is transported to a central location for processing, rather than used at the farmer's location, additional information must be recorded in the Biochar Received task. The data includes distanced transported, a receipt for the amount of biochar purchased and other information.

- Step three. When the biochar is **used** in the soil or in animal feed, the farmer or local team members captures relevant information such as pictures and GPS coordinates of where the biochar is applied, the exact location, and the distance traveled, if any. All information and file(s) are persisted to the blockchain.

Verification - after Steps 2 and 3. Once the data is entered by the farmer or by local team members on the ground, designated managers (verifiers) from the Biochar Life team review each entry for completeness and the transaction is then approved to be recorded on the blockchain.

Once the information is verified then the farmer is paid. Currently, the payment is made via local fiat currency. In the future, payments via regional microfinancing services or via the app will be used.

Random audits and sampling. As part of the EBC requirements, random sampling is performed by a 3rd party lab for **chemical analysis**. The full report is uploaded to the blockchain. We leverage local universities to perform chemical analysis. The primary function of these tests is to verify the carbon content of the biochar, which is critical for determining how much CO2 is sequestered when the biochar is buried.

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Feedstock

A wide range of agriculture-based biomass feedstock is acceptable and supported by the solution. Based upon the EBC requirements, the solution adheres to the *Positive list of permissible biomasses for the production of biochar*. See link below for full list.

https://www.european-biochar.org/media/doc/2/positivlist_en_2022_1_v10_1.pdf

During the project setup, Biochar Life will review the feedstock to be used for biochar production and ensure it meets the EBC requirements. The solution's data fields and calculations will be updated for any new feedstock types.

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Pyrolysis Technology

The solution accommodates multiple types of “low-tech” pyrolysis technology. Those include: all forms of trough, pyramid, cone, soil pit, Wilson kiln, Kon-Tiki and TLUD. The emission and quality data used in the certification are based on the below publication.

https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0154617

During the project setup, Biochar Life will review the equipment to be used for biochar production and ensure it meets the EBC requirements. The solution’s data fields and calculations will be updated for any new equipment types.

The solution ***excludes*** traditional kiln methods which do not combust the pyrolysis gasses due to the resulting emissions of gasses and aerosols that are toxic and contribute to greenhouse gas emissions.

Emissions and C-sink potential

As stated above, the solution accommodates multiple types of projects and activity types. The different types of projects and activities ensure the necessary data is gathered to account for any emissions generated throughout the process.

The solution accounts for the following emissions:

- Biomass (preparation, transportation, etc.)
- Pyrolysis (includes CH4-emissions due to low-tech equipment)
- Post-pyrolysis (preparation, transportation, etc.)

Additionally, we incorporate a “margin of security” of 10% for emissions to help account for any variance in emissions generated.

A critical aspect of the solution includes consideration for any CH4-compensation methods employed by the farmers. Currently, the solution incorporates two types of CH4-compensation methods: prevention of open field burning and planting of trees. The CH4-compensation offsets the CH4 emissions generated via the pyrolysis process.

The solution takes into consideration the Carbon content based on prior research and published values, such as the IPCC - Table 4aAp.1 as shared below or Phyllis2 database.

https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/4_Volume4/19R_V4_Ch02_Ap4_Biochar.pdf

Furthermore, the solution includes random sampling of the biochar by independent laboratories to ensure the Carbon content values are in alignment with the averages used within the C-sink potential calculations.

The C-sink potential (net C-sink) includes total GHG emissions per tonne of biochar (dry matter). Once the net C-sink has been calculated, the **total C-sink value is reduced based on the degradation of the Carbon after 100 years (C-sink$_{100}$).**

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C-sink and Social Impact Certificate

A C-sink and Social Impact Certificate is created for respective biochar production and usage activities. The certificates are aggregated based on the following criteria:

- Region (e.g., Malawi)
- Feedstock biomass
- Equipment type
- Usage (i.e., application)
- CH4 compensation method

More than one certificate may be produced for a specific project or region.

Each certificate includes four (4) sections:

- Emissions and C-sink data
- Details about C-sink and social impact including methods used to calculate values
- Annex 1: table of underlying production and usage data (links to details of each record)
- Annex 2: map of each Carbon sink

The following is a sample certificate for reference.
https://drive.google.com/file/d/19gfufmGrzJoOlfcq7_0I-gowmFFQIsFy/view?usp=sharing

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STS token and Certificate NFT

The solution includes the creation, management and tracking of a Stellar blockchain asset called Stop-the-Smoke (“STS”) token. The value of one token is equal to one (1) tonne of CO2eq.

Once a certificate is generated and the C-sink$_{100}$ value is determined then an equal amount of Stop-the-Smoke (“STS”) token is minted on the Stellar blockchain. The amount of STS tokens minted will equal the C-sink$_{100}$ value.

PLEASE NOTE: STS tokens generated prior to 2022 may reference Biochar Trust and were a part of the early pilot and testing phase.

After the STS token has been minted then an NFT is created on the Stellar blockchain which includes the C-sink and Social Impact Certificate pdf file. The pdf file is stored using the Interplanetary File System (“IPFS”). The NFT and associated data provides buyers of the certificate an immutable record and proof of the C-sink.

Once the NFT has been minted then it is available for purchase on thebluemarble.io NFT marketplace provided by Task.io.

Project Setup & Types

A project must be reviewed, approved and set up on the Task.io platform before using the procedures and system. As part of the setup and configuration, project-specific requirements will be incorporated into the core platform and task templates, such as but not limited to: crop type, equipment used, c-sink calculation, CH4-compensation method, etc.

Currently, the solution can adhere to three different types of projects. Each project type accommodates different biochar production and usage methods which in turn ensures the necessary data is gathered to account for emissions and C-sink potential calculations.

Type 1
The farmer makes and uses the biochar on their land.

Transportation activities:
- The biomass or biochar is not transported.

Types of biomass: corn cob, stalk, tree trimmings, cocoa pods

Task.io tasks:
1. Biochar Produced
2. Biochar Used

Example cases:
After harvest, the farmer collects the biomass and produces and uses the biochar on site.

Countries adhering to this process:
- Thailand
- Malawi
- Kenya
- Indonesia
- Ghana

Type 2
The farmer makes the biochar onsite but the biochar is used at a different location(s).

Transportation activities:
- The biomass is not transported.
- The biochar is transported.

Types of biomass: corn cob, corn stalk, tree trimmings

Task.io tasks:

1. Biochar Produced
2. Biochar Received
3. Biochar Used

Example cases:
After harvest, the farmer collects the biomass and produces the biochar on site. The biochar is transported to a central location for verification, bagging and distribution for usage. The biochar will be recorded as Biochar Produced by the farmer and Biochar Received by the Collection point. The Batch Number can be used by Biochar Received to associate it to the farmer's production.

Countries adhering to this process:
- Thailand

Type 3
Type 3 is used when a large volume of biomass is accumulated at a centralised location. The biochar is produced near the biomass by moving the equipment to the biomass site.

Transportation activities:
- The biomass is transported.
- The biochar is transported.

Types of biomass: corn cob, tree trimmings

Task.io tasks:
1. Biochar Produced
2. Biochar Used

Example cases:
Multiple farmers transport their corn crop to a central location for shucking. The expended cobs are collected in large piles and converted into biochar. The TLUDs or other equipment are set up near the cob piles for production.

Orchard trees are pruned and biomass is collected. The trough is moved from tree to tree for production

Countries adhering to this process:
- Thailand

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Data Capture and Verification

Prerequisite: A data plan, internet connection and smartphone are required to use the Task.io app. The Task.io app can be downloaded for free from the respective Apple and Google stores.

The Biochar Produced and Biochar Used tasks must be recorded for all kg of biochar. These tasks include the key data points, images and files that support the EBC accreditation.

1. Biochar Produced (Step 2 in Solution Overview)
    a. When a farmer is preparing to produce biochar, a local team member will schedule a time to visit the farmer's site.
    b. At the site, the team member will record the information in the Biochar Produced task and submit it for verification. **At a minimum, the following photos should be included. If taken through the Task.io app they will be geo-coded. If they are to be entered at a later time, make sure the camera captures the GPS coordinates, date, and time:**
        i. Picture of the production method.
        ii. Picture of the biochar pile produced.
        iii. Pictures of the volume-weighing process, including a final picture that captures all of the bags arranged in a countable fashion.
        iv. Pictures of our team members randomly selecting bags to verify volume/weight.
        v. Picture of farmer declaration form.
        vi. Picture of the field used for growing the crop.
    c. In some cases, the team member will randomly verify the volume of the biochar.
    d. A designated verifier (i.e., manager) will review the submitted task and approve or decline the task.
2. Biochar Used (Step 3 in Solution Overview)
    a. When a farmer is preparing to use the biochar, a team member will schedule a time to visit the farmer's site.
    b. At the site, the team member will record or teach the farmer to record the information in the Biochar Used task and submit it for verification. **At a minimum, the following photos should be included. If taken through the Task.io app they will be geo-coded. If they are to be entered at a later time, make sure the camera captures the GPS coordinates, date, and time:**
        i. Photos of the location.
        ii. Demarcation of the land (GPS) where the biochar was applied.
        iii. Photos of the use, including production processes if an animal feed is made, floor litter or other item is manufactured.
        iv. Photos of the number of bags used.
        v. Photos of the final application of the biochar.
    c. A designated verifier (i.e., manager) will review the submitted task and approve or decline the task.

Biochar Received and Chemical Analysis tasks are available for select processes. They will be recorded on a case-by-case basis.

Initially, a Biochar Life team member or local network partner team members will record all tasks using a smartphone. Over time, farmers with smartphones will be trained and record tasks to help facilitate scale.

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Appendix 1 - Farmer Declaration Agreements

Make a copy for each farmer to fill out and sign. If the farmer typically burns the crop residue/waste then complete the Cease Open Field Burning form. If the farmer uses the crop residue/waste for other purposes such as livestock feeding then use the Tree planting form.

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Farmer Declaration Agreement - CEASE OPEN FIELD BURNING

This non-binding agreement is a record of the farmer's written intent to cease open-field burning of the crop waste biomass. The farmer will act in good faith to use the crop waste biomass to produce and use biochar so as to prevent the emissions created from open burning and making biochar.

The information provided below will be kept confidential and included with the record of biochar production.

Farmer name:

Land owner name:

Land location coordinates:

Size of the crop field:

Land use / crop:
(Please include any crop rotation.)

Signature:	Date:

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Farmer Declaration Agreement - TREE PLANTING

This non-binding agreement is a record of the farmer's written intent to plant and care for a tree. The farmer will act in good faith to care for the tree for a minimum of 20 years so as to compensate for emissions created during the making of biochar.

The information provided below will be kept confidential and included with the record of biochar production.

Farmer name:

Land owner name:

Land location coordinates:

Size of the crop field:

Land use / crop:
(Please include any crop rotation.)

List number of trees and tree species:

Time period of plantation and location:

Signature:	Date: